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THE CONSERVATION OF OUR LAND RESOURCES[1]

By Professor JACOB G. LIPMAN

DEAN OF THE COLLEGE OF AGRICULTURE, RUTGERS UNIVERSITY

OUR domestic empire has grown with the spread of land occupation. In historical perspective it was yesterday when a few venturesome spirits struggled to maintain a foothold on a fringe of land stretching from Virginia to Massachusetts. In terms of to-day we are trustees of 3,000,000 square miles of land on the North American Continent. A little of this land has been occupied for about 300 years. Most of it has been occupied for less than 100 years; and many millions of acres of present-day farm land had not been touched by the plow fifty or even thirty years ago. Human currents have eddied and moved forward, to the West, the Northwest and the Southwest. The conquest of the wilderness and the building of homes represent one page of our national record. The opposite page tells another story; one of land exploitation, soil wastage, agricultural decadence in many places and of people wandering back and forth. Now we are in a mood of contemplation and of looking into the future.

[1] Address of the vice-president and chairman of the section for agriculture, American Association for the Advancement of Science, St. Louis, 1935.

WHAT HAS HAPPENED TO OUR LAND?

Let us consider a very few statistical facts. We have not much less than 2,000,000,000 acres of land surface in the Continental United States. Half of this land is in farms, and a quarter of it is so-called crop land. When the first white settlers came to North America there were about a billion acres of virgin forests within our present national boundaries. Most of these forests have disappeared. They were cut down, burned over and converted into crop acres and pastures. Most of the forest clearing and burning was inevitable. There was no other way for the building of a great nation. But there has been a terrible wastage of timber, of soil and of human effort. We

now realize that in the building of 6,500,000 farm homes we have changed our agricultural geography too much and too often. We have condoned excessive land abandonment, soil depletion and ghost farms, just as we have condoned ghost lumber camps and ghost mining towns. We have paid the price in gullying, in sheet erosion, in soil leaching, in the irrational destruction of soil organic matter. But even this does not tell the whole story. Witness the destructive floods, the silting in of streams and reservoirs, the formation of fans and deltas and the raising of dikes and levees that can not always withstand the rush of mighty floods. Yes, we have sinned against our land and are stirring uneasily as we think of the future.

The Land and Its People

The future of our land will reflect the future of our nation. Lest we take this too lightly, let us consider some facts, some of them in the far reaches of human experience, some of them at our very door. As in the remote past, so in this day, food and clothing and in large measure shelter have as their basis the raw materials of the soil and the air. The air and the sun we shall leave, for man can not do much to change their ways. But as to the land, consider the nomads of Asia and of Eastern Europe. Consider countless generations of men and animals grazing, feeding, building flesh and bones, concentrating in their bodies the calcium and phosphorus of the soil. Consider overgrazing; clouds of dust moving somewhere century after century; the rush of flood-waters growing more intense as the plant cover was eaten and burned off. Consider rocks as the bones of the land and soil as its flesh. Think of hillsides laid bare; of bad lands; of great streams meandering over alluvial plains, carrying a vast burden of silt and clay and withal a great load of dissolved matter. Think of silt deposits in offshore waters, of lowlands and dikes and of the puny efforts of man to reclaim land from the sea as partial compensation for the tribute which he had paid to wind and water uncontrolled.

Ancient peoples lost their land as they lost their soils. There is the oft-repeated story of denuded hillsides, terraces undermined and vanished, stream courses clogged and malaria rampant. Rome drew the strength out of its own soils. It reached out farther and farther to regions not yet despoiled, it drove its slaves to exact the utmost from the land. Thus war and slavery, prompted by greed and vainglory, proved a sorry substitute for land conservation and the adjustment of population needs to carrying capacity. Other empires of old traveled the same road and met a similar fate. But despite the facts of history there are nations who still believe that war and economic slavery, imposed on others, are to be preferred to land conservation and the maintaining of a proper balance between population and the carrying capacity of the land.

Factors of Land Conservation

We learned from the census of 1930 that our farm population represented no more than a fourth of our total population. Numerically, it was great enough to supply us with food, fats and fibers, and, beyond that, to export enormous quantities of cotton and of other agricultural commodities. It had not yet reached its maximum production efficiency. Its output per capita was relatively high, its production per acre, relatively low. Many of our farmers lived in communities more or less isolated. There were human islands in the hills and in valleys under-schooled, poorly housed and miserably fed. They struggled with gully and sheet erosion, with chemical depreciation of their soils. Their farms were burdened with debt, their buildings were in disrepair, their crops were growing smaller and their live stock were shrinking in weight and size. Soil conditions were being reflected in social and economic stagnation. Since 1930 there has been a migration landward, a trend toward higher economic returns from the land and a growing consciousness of the nation's responsibility to the land and of its place in a well-ordered commonwealth.

Plans and Programs of Land Use

Let us consider the demands made on land by modern society. In the first place, provision must be made for areas to be given over to crops and pastures. More or less extensive areas must be set aside for forests and others for recreational uses, water storage, residential and industrial sites, roads and other uses incidental to the maintenance of our agricultural, industrial and commercial activities.

Agriculturally speaking, no civilized nation is sufficient unto itself. To a lesser or greater extent, foods, fats, fibers and other agricultural commodities must be imported. In some instances, as we know, the importations are relatively slight; in others they are of substantial proportions. The relation of imports to exports of agricultural commodities must be determined, in each country, by land resources, climate and the political, economic and social organization of the commonwealth. There is ample room for adjustments that, in the long run, will be of benefit to the nation concerned. With economic nationalism in the saddle, the rules of logic are often ignored. None the less, the agricultural use of land, in most countries, is directly or indirectly affected by the price level of staple agricultural products in the world's markets. A greater degree of international cooperation would bring about shifts in the use of land for the production of crops and live stock, as well as of forest prod-

ucts. Our own country will make such adjustments as in our own thinking will strengthen our economic and social structure. For the sake of developing a balanced land-use program, we must consider most earnestly certain of the major facts and implications involved.

SURVEYS, INVENTORIES, CLASSIFICATION

Geodetic, topographic and soil surveys have been in progress in our country for many years. Some of our topographic and geological maps are among the best of their kind. A considerable proportion of our agricultural land has been covered by detailed or reconnaissance surveys. Maps have been made available to us which indicate our soil provinces, soil series and soil types. More recently there have been produced maps showing the great soil regions of the world. We are thus able to establish a fairly adequate inventory of our soil resources from the point of view of texture and crop adaptations. A great volume of additional soil survey work is still to be done. In the same way, we are in possession of many thousands of analyses of representative samples of our important soil types. Here, much additional information is needed. Nevertheless, we already have a basis for establishing an inventory of the physical and chemical resources of our land and soils. When the information on this score becomes more adequate, we shall be in a position to classify our agricultural lands from the point of view of their inherent productive capacity. We shall be able to measure the gains and losses of plant nutrients, and shall have a basis for the rational use of the land for the benefit of agriculture as well as of industry and commerce. Due emphasis should be laid, at this time, on the need of completing our surveys, of carrying farther the preparation of maps, and the speeding up of physical, chemical and biological soil studies as a basis for the most effective use of our land and soil resources.

THE PROTECTION OF OUR LAND AND SOIL RESOURCES

We know that the continents are being gradually planed down. We may designate this process as geological erosion. As measured in human terms, this is a slow process. The rate of soil removal, except on the steeper slopes, is offset or is more than offset by the rate of soil formation. Hence, under an adequate plant cover of forest or grass, the depth of the soil tends to increase; but when arable farming subjects the land to various types of management, soil removal is speeded up, often to a point where the entire top-soil is lost in a relatively short time. The destructive effects of erosion are easily observed in many places in the United States; indeed, in some localities, the landscape is dotted with gullies and abandoned fields. Sheet erosion, while less spectacular, is often no less destructive. Many millions of acres of land have lost their surface soil within a generation. They are occupied, if at all, by people who have been designated as "sub-soil farmers." Obviously then, we must plan and carry out systematic procedures for the protection of our land against gullying and excessive sheet erosion.

Carefully conducted studies on the silt load of our streams indicate the removal of three to five billion tons of fine sediments from the soil surface of the United States. This load, suspended in moving waters, is dropped on the way, and a large proportion of it deposited in tidal waters. There is another type of soil wastage which is not recognized as readily. This has been designated by F. W. Clarke as "chemical denudation," and the mass of dissolved material in our surface waters as the "chemical load." The total volume of calcium, magnesium, sodium, potassium, iron, sulfur, chlorine and of various other ingredients carried annually to the sea is truly enormous. Our soils are gradually being deprived of a portion of their basic elements. Given a period long enough, and protection from erosion adequate enough, soil decomposition may proceed to a point where only the silica skeleton remains. An effective plant cover will protect the land against undue losses resulting from erosion and soil leaching.

There is other damage that is being done to our land. Floods not only increase the silt load of our streams, but often do damage by covering fertile land with a layer of sand and gravel. Fires which occur in our forests, our prairies and peat lands destroy millions of tons of organic matter, and allow the fixed carbon to escape as carbon dioxide. Fires and overgrazing lessen the effectiveness of the plant cover as a soil-conserving agent. Where the land is overgrazed, the surface material is moved, in greater or lesser amount, by air currents. In the course of time, a vast volume of surface material may be removed by the prevailing winds; and good grazing and other agricultural land may thus be seriously damaged.

Over vast areas of our arid and semi-arid region, the improper use of irrigation water has led to the accumulation of soluble salts in the top-soil to a point where the land is no longer productive. Alkali accumulation and increasing salinity are of common occurrence in some of our irrigated areas. In other sections, the rise of the water table has created drainage problems. In still others, the water table has been gradually lowered by pumping so that the underground water resources are no longer sufficient for maintaining a profitable agriculture. We may cite numerous instances where undesirable plants, insects,

microorganisms and animals have increased to a point where they are detrimental to farming, grazing and forestry. In considering plans and programs of land conservation, these and other factors must not be left out of the reckoning.

Rationalization of Production

At any given subsistence level, and with any given dietaries, we can tell what our food requirements may be. For example, a population of one hundred and thirty million people will require, at five bushels per capita, something like six hundred and fifty million bushels of wheat. This is aside from requirements as to seed. Our per capita consumption of wheat, corn, oats, barley, rice, potatoes, etc., may rise or fall. Our prevailing dietaries may be improved upon, but by and large, we are sufficiently well informed to be able to determine what we may need of cereals, vegetables, fruits, dairy products, meats, spices, condiments and what not for maintaining proper food standards. In the same way, we know what we may require of fibers, fats, starches, celluloses, organic acids and other agricultural commodities for direct consumption or processing. We may readily ascertain, therefore, what the land must provide. On the other hand, we have not come to the point of rationalizing production as to place and time. We should set out to determine where our foods and industrial raw materials should be produced. Should the great volume of wheat or corn, or tobacco or cotton, or vegetables and fruits, to say nothing of milk or eggs, be produced in one place or another? From the standpoint of yield levels, production and transportation costs, which should be the favored localities? Again, we have too much agricultural land in use partly because of the relatively low yields per acre, and partly because of the tremendous wastage which occurs on account of weather, insects and microorganisms. What are the economic and social considerations that would justify more or less far-reaching adjustments in yield levels and in the distribution of crop areas with due regard to national as well as local interests?

There are many soil areas of fine physical and chemical quality but containing an insufficient amount of one or another chemical ingredient. Far-flung soil regions of the United States are deficient in phosphorus; there are others deficient in potassium or magnesium or nitrogen or even manganese, boron, zinc, copper, etc. Soil deficiencies are reflected in physiological plant deficiencies, and these, in turn, in animal deficiencies. Animals may become stunted, emaciated and deformed because of the lack of sufficient amounts of essential ingredients for the building of the animal body. Again they may be abnormal because of the presence in the soil of toxic substances. The progress of soil research has already made it possible for us to recognize the nature of soil deficiencies, and to devise more or less effective means for correcting them.

The plant physiologists have shown us how to grow plants to maturity in water or sand culture. Under special conditions, their methods and procedures may be commercialized; but for the production of staple crops and live-stock products, we must depend on soils, as they are subject to modifications by soil management, but always within economic limits. Among the major constituents of soils whose importance we have underestimated is organic matter. It is not enough that a soil contain the essential ingredients for the production of plants. The soil must be able to absorb and store sufficient quantities of water. Their texture and structure should be such as to provide optimum conditions for the vertical and horizontal movement of water and air. A good soil must furnish a source of energy to various microorganisms which are a positive factor in crop production. Soil organic matter is a source of food and energy for microorganisms. Soils may contain an excessive quantity of water. This represents a problem in drainage. Other soils may be undersupplied, and irrigation may be resorted to, if the cost of it is not excessive. We must consider such types of soil and crop management as will lead to the greatest net returns from the land. The organization of production must go hand in hand with the organization of distribution. All told then, the rationalization of production will call for far-reaching adjustments as to the location of the major production areas, yield levels, farm organization and planned and controlled distribution.

Commercial and Part-Time Farming

The tides of migration have risen and fallen between city and country. In absolute terms, our farm population is as great as it ever was; in relative terms, it has been shrinking consistently since the early days of colonization. The growing efficiency of American agriculture released a greater number of people for the building of our cities, of our industries, our commerce and transportation. Production efficiency in agriculture is still growing. Despite the fact that a strong return current had set in in the period of 1930 to 1935, with the resulting addition of millions of people to our farm population, this, presumably, is a temporary phenomenon, even though the adjustments ahead of us will involve the placing of relatively as well as absolutely greater numbers of people on the land. We can vision the gradual development of two types of farming in the United States. One of them may be designated as commercial farming; the other as part-time farming.

Commercial farming will utilize all the expedients of science and technology as well as of business organization and management. These large farms will be held either by corporations or by farmers' cooperatives. They will be so managed as to promote the conservation of the land, the raising of yield levels and the improvement of crop quality. There will be the question of the distribution of population as it may be affected by large-scale farming, on the one hand, and part-time farming, on the other. There will be the question of agricultural commodities as raw materials in manufacturing of, let us say, fuels, plastics, celluloses, organic acids, higher alcohols and what not. Present-day systems of marketing and distribution will undergo far-reaching changes. The interrelations of agriculture, industry and commerce will be more clearly defined. Our taxation systems, certainly land taxation systems, will, of necessity, undergo substantial modifications. Industry will draw an increasingly greater proportion of its employees from families living on small farms and deriving a part of their living from them. We may thus readily vision land-use planning as the touchstone for the redistribution of population and industry; for the rationalization of production; and for the steady rise of earnings and living standards.

Incidental Use of the Land

In planning the use and conservation of our land resources, we shall make provision for playgrounds; for game preserves and wildlife sanctuaries; for fisheries; for storage reservoirs; and for the effective management of areas that would assure us of flood control. Obviously, agriculture, industry and commerce have a stake in this great enterprise. As we develop and maintain our forest resources, we shall almost automatically provide also for playgrounds, wildlife sanctuaries and more effective control of soil erosion, soil leaching and the silting in of streams and reservoirs. It is no less obvious that we are dealing here with a group of local problems that seem to fuse, as we study them, into one great national problem. Time and again, we must return to the conclusion that the conservation of our land resources lies at the bottom of our national security and progress.

Educational Factors

Physical resources are in themselves of slight value. It is only human intelligence and human knowledge that may put value into these resources. Technical information and a sense of moral values are the key which alone can unlock the door of the treasure house. We must know how to make bread out of stones and beautiful landscapes out of raw earth. It is essential that, in dealing with the conservation of our land resources, we do not fail to educate and train our men and women to the point of greatest adequacy and effectiveness. General and vocational training and education, an understanding of economic and social values and such organization of local, state and federal governments as would provide the needed safeguards, the best guidance and the most thoroughgoing coordination of all social efforts are the ideal toward which we should strive. Our strength lies in the soil; our hope, in the land; our salvation, in the upward climb toward the higher peaks of economic and social justice.

THE CONFUSION OF TONGUES[1]

By Dr. OSCAR RIDDLE

CARNEGIE INSTITUTION OF WASHINGTON, STATION FOR EXPERIMENTAL EVOLUTION, COLD SPRING HARBOR, N. Y.

To this point in this discussion we have invited you to recall something of the broad scope and fine heritage of the zoological sciences; something of the great significance, and also the adequate establishment, of the evolution principle; and something of the inestimable human values which lie in the numerous disclosures of practically all branches of our science within the past 30 or 35 years. Let us now desert the laboratory and make a bit of an excursion. The direction or distance we go doesn't much matter; wherever we turn we shall meet man—whom Shafer calls a fearful compound of grandeur and misery—and we shall encounter schools and laws and tradition, in short, the world for which we and our laboratories exist.

Within the past thirty years in this country the number of anti-science, anti-medical, anti-vivisection and anti-evolution crusades has greatly increased. Before some state legislatures biologists and medical men must each year give valuable time to fighting the annual anti-vivisection bill. In still other states that fight, like the one on the teaching of evolution in public schools, is already lost. A public unfamiliar with the nature and contribution of animal study is the prepared ground for all these "anti" societies; and on such a public counter-arguments are peculiarly inef-

[1] Continuation of the address of the vice-president, Section F (Zoological Sciences), American Association for the Advancement of Science, St. Louis, January 1, 1936.

fective. Here, as at any other point which we may wish to touch, the biologist of to-day is seen to have become isolated and insulated from the public whom he could so capably serve. These and other things to be encountered on this excursion lead me—as an investigator in biological science—to conclude that far more important than important new biological discovery is now the matter of getting a great many more new ultimate consumers for the body of biological knowledge that is already at hand.

I have recently given some special effort to learning the extent to which the great and rapid enrichment of biological science has been reflected in secondary school teaching during the past thirty years. Though life-science in the high-school curriculum has never been other than a very subordinate subject, and though data permitting a satisfactory comparison scarcely exist, my examination of the question leads to the conclusion that in general not more but less per high-school pupil is being taught to-day than was taught their elders thirty years ago. In some measure we must now document this statement.

In Bulletin No. 16 of the U. S. Office of Education it is reported that in 1905 there were but eighteen subjects studied in our public high schools, while in 1928 there were 156 such subjects. Data for the amount of biological science taught per pupil in 1910 and 1928 —the dates nearest to the periods we want—are there given. In this eighteen-year period the percentage of pupils enrolled in aspects of biological science changed as follows: In physiology, a decrease from 15.3 per cent. to 2.7 per cent.; in botany, from 16.8 per cent. to 1.6 per cent.; in zoology, from 8 per cent. to 0.8 per cent. The apparent losses are partly unreal, since these subjects were in part replaced by 13.6 per cent. of biology and by 17.5 per cent. of general science. Counting as biology one third of this general science course we obtain a total enrolment of 24.5 per cent. in biological science in 1928, compared with 40 per cent. in 1910. Since, however, these figures are subject to error, let us say merely that they suggest a nation-wide decrease in high-school teaching of biological subjects between 1910 and 1928; and then let us note more definitely that (since total enrolment—about five subjects in each of four years—of these pupils was 497 per cent.) the biological instruction of American high schools in 1928 constituted only one twentieth, or 5 per cent., of their total high-school training.

A similar bulletin (No. 17) for 1930 records that—though there were frequent biological electives—biological science was a "required" subject in only 8.6 per cent. of thirty-five specially studied public high schools of small cities (16,000 to 27,000) scattered through the North Central States. Data from these same schools (Stout, Van Dyke) for 1906–11 do not properly cover the point, but it is practically certain that thirty years ago biological science was a "required" subject in much more than 8.6 per cent. of these same schools of North Central States. Again (Bulletin No. 16), "In 1910, 82 per cent. of the total enrolment in public high schools were studying some science, 65 per cent. in 1915, 64 per cent. in 1922, and 61 per cent. in 1928."

Of ninety private secondary schools asked by the Office of Education, about 1932 (Bulletin No. 17), for some special information concerning their curriculums, twenty-six made usable replies. The twenty-six schools are located in all parts of the United States except the far West, and include boys' and girls' schools, military schools, college preparatory schools and schools of various Catholic and Protestant groups. From the published data it appears that only fourteen of these twenty-six schools require any science subject whatever for graduation; three require biology, and eight require science or general science. A rather reasonable calculation from the published data indicates that in these schools, considered as a group, the "required" instruction in all the sciences did not exceed 3 per cent. of their total instruction.

Of the high-school graduates of five cities (Bulletin No. 17) in 1930 the following percentages had studied no science whatever; Denver, 10.7 per cent.; Washington, 0.4 per cent.; Joliet, 5 per cent.; Long Beach, 2 per cent.; and Providence, 7.5 per cent. In the latter city another 67 per cent. of the graduates had studied general science alone; only 1.5 per cent. had studied biology in addition to general science; and another 1 per cent. of those graduates had studied general science, biology and chemistry. Perhaps we should pause to congratulate that group of graduates on its scientific outlook.

A final item of figures. Relative amounts of science, all kinds together, studied by the graduates of seven high schools located in Denver, Providence and Long Beach were obtained (Bulletin No. 17) for the years 1900 and 1930. In 1900 sciences comprised 16.3 per cent., and in 1930 only 6.9 per cent. of the total studies of the graduates of these same schools.

These several items—some dealing with a few schools and some of them national in scope—indicate that biological science now has a very inferior place in our secondary education; and that, at least in many and widely scattered areas of our country, its position is now definitely inferior to that of thirty years ago. Thus in an early stage of our excursion we meet an amazing situation. Since we are students we ask—Why, in its own period of unprecedented fruitfulness, has not biological science obtained and maintained its proper place in the education of our people?

It seems reasonable that our secondary schools should supply most of the needed new consumers of

our biological store. Personally I am fully convinced that at least a fivefold increase in the present teaching of biology in our high schools is necessary alike to an acceptable secondary education and to the most vital aspects of our social and national welfare. In this statement I think of biology, and particularly its zoological aspects, not as an end, only as a means; but—because it supplies the background of man, because it is replete with the things intrinsically important to our own lives and personalities and because it carries the discipline of a solid science—biology takes first place at the high-school age as a means of education. I submit the view that life-science merits study throughout the four-year high-school period; and for that considerable percentage of students which now takes no biology whatever not less than two years of such study should be required. One finds that physics and chemistry have likewise lost part or much of their position of thirty years ago in secondary schools. Prior to forty years ago those sciences probably provided a better discipline than did the biology of that day; the reverse is probably the case now. We all know that the experimental method twinned with checked observation has been the main method of man's rise from barbarism to civilization; that it has been the method by which the awe-inspiring facts about the universe and man himself have been obtained. If our high schools can not find opportunity to give familiarity and training in that method, just what kind of opportunity are they looking for?

But the quantity of biology taught in secondary schools may be affected by or dependent upon many things. Its quality is of even greater importance, and for a moment our excursion may as well turn back to the campus. Once back in our own laboratories we recall that the high-school teacher must be trained, and we may as well unflinchingly confess that any inadequate course offering, or any instruction badly performed there, has surely been a liability, not an asset, to the place of our science in general education. In this day a good biological laboratory is a treasury of opportunity and of fine enterprise; but a bad one is a blight and a menace.

Incidentally, while on the home grounds we may not forget that a great many educational miscarriages occur at points above the high school and college. To men well trained in life-science the mental outlook and equipment of many products of even the graduate school are a source of frequently recurring surprise. I can cite the case of one who, in a discipline related to biological science, was granted the Ph.D. degree by, and now occupies a post in, a great university. This finished product of university teaching does not—even qualifiedly or noddingly—accept the basic principle of organic evolution. Perhaps some of you may know an equally absurd and abortive case.

Across the way from our laboratory is the office of the dean of the college, and we now reflect that it is from there that the vicious influence of college entrance requirements presses down on the curriculum of all high schools. Though only a small percentage of our high-school students ever enter college that dictatorial foreign body largely mandates that no community may do the thing that should be axiomatic—namely, use its high school to produce a good citizenry. It is calamitous that some things are impossible. What a boon to good citizenship if only the endowers of our colleges could come to life and withdraw their gifts from all colleges which can not profitably begin where any good high-school training leaves off!

Again, the school of education is now also here on the campus. Since problems of secondary education are in mind we may first warmly thank our colleagues in education for their unquestionable aid in the correction of many errors of the high-school curriculum of thirty years ago; though those who should perhaps best know the special and irreplaceable values of life-science may greatly doubt that this subject has been properly appraised by most of them. The educationists are also linked with us in the task of making teachers of biology; indeed, it is sometimes found that they have taken over the entire job. This is a matter of much importance. Conceding that most teachers of secondary school biology will profit by some instruction in the art of teaching, it must be equally conceded that a full college course of solid biology is an irreplaceable and still inadequate training in subject-matter. Somehow, teacher training must be quickly done; biological training of the teacher must be thoroughly done. Dean Gildersleeve recently charged that, due to a growing "racket" in teacher training, it is "rapidly becoming impossible for graduates of our best liberal colleges to teach in the public schools of this country." The presumption that for making a teacher of biology there is any substitute for long-continued training under our best college biological departments is an expensive fraud; and the extent to which that presumption is being enforced in one or another guise is now an educational disgrace.

Let us now look more widely about us and learn, if possible, how our best biological research is impressing others. The daily and weekly press supplies most of the reading matter for many or most of the world's population from the high-school age to the end of life. The effectiveness of our biological research and teaching will perhaps be mirrored in newspaper editorials. I elect to quote briefly from a long editorial of the European edition of the *New York Herald*, under date of September 13, 1935. It is captioned " 'Evolution' not dead."

> There are scientists who say that evolution is dead, and others that it is not. It is a matter of opinion, for as

Darwin himself said, "evolution is a theory subject to future proof," and there is still no proof today. . . . The controversy came up again at the meeting of the British Association which closed this week at Norwich. It was reopened a few months earlier by a physicist, Sir Ambrose Fleming, who in a presidential address to a meeting of scientists asserted that the Darwinian theory was "the product of imagination." . . . But if "evolution" is not dead, it has hardly the force to-day which it had when Huxley wrote these (omitted) words. The issue has lost much of its passionate interest for the public. It is felt more and more that the theory of evolution is a question for scientists alone.

Now the naïveté of this particular statement is an incidental matter. We have a highly intimate interest in it because it is so truly representative. A biologist would have to be both thick-skinned and asleep to escape the real and personal implications of the unending shower of such editorial expression. We biologists have done amazingly well, but we have failed. The laboratories have conquered, but their triumphs are sealed within their walls. Darwin and Huxley, with quite unfinished materials, met the minds of men far more effectively than we now meet them. Precisely when we have most to contribute we are becoming insulated from the great stream of intellectual life.

We again look elsewhere. During the past fifteen years five states (if we include Utah) have passed laws which prohibit the teaching of evolution in their public schools. This prohibition, and a strong sentiment of similar nature elsewhere, implies several most serious things. We know the importance of the text-book, and we may first note that this sentiment has written itself into some text-books widely used in both high school and college. These books put not emphasis but a wet blanket on one or all aspects of the evolution principle; and they often succeed in leaving only a pale ghost of our science in the student's hands. I submit as evidence some excerpts from an elementary text-book published in 1934 and already introduced into more than 131 normal schools and colleges in at least thirty-seven of our states and territories. A chapter of this book is entitled: "The process of evolution cannot yet be satisfactorily explained." The final section of this chapter is dedicated solely to the proposition that what it calls "the doctrine of evolution"—but evidently only Darwinian work is included—"is quite compatible with a religious faith." Of course to the untrained pupil this can only mean that it is quite compatible with whatever view of religion, or of the supernatural, he or she happens to have at the moment. I quote from four paragraphs the following illuminating lines:

"The reader should remember that even Darwin himself did not believe acceptance of the evolutionary idea to be incompatible with a religious faith. . . . Why should the full-blown rose, the birds in the trees, the beasts in the field, and the stately oaks standing in the forest not be considered to be as much a part of God's world as the subjects of which the Bible treats?" There follow four lines from the Psalmist, and then this: "If this conception of the universe were kept in mind it would obviate much strife and confusion. The scientist can make no distinction between the natural and the so-called supernatural. What man can study, experience, and learn about through his senses is the natural; the supernatural is that part of the universe which he has not yet been able to understand (*sic*) or for which his powers of comprehension are too limited. There is no difference between the two. The difference comes only in man himself. . . . So, then, since evolution neither denies the existence of God nor disclaims His directive influence over natural processes, it cannot be said," etc., etc. Then, "Finally, it must be remembered that the theory of evolution does not attempt to say when, why, or by whom life was first produced upon the earth. The honest scientist when pressed for an answer will say candidly that he does not know."

Why any text-book whose purpose is to outline and guide in the study of life-science should contain a single word on the subject discussed at such length in this book is beyond comprehension. Your zoologist who loves, teaches and builds his science—and is not especially worried about teaching others how to teach zoology—very well knows that his task is to facilitate an advantageous encounter between the student and the useful and vitally significant phenomena and principles of biology. As a true scientist he will not rob his teaching of that special and incomparable discipline which only the sciences can give—his student will have to wrestle with the facts and principles he finds. If, and when, astonishment at the inclusion of such material in a text-book is sufficiently overcome, the biologist who knows that his science to-day is not where Darwin left it will swear that he had not believed it possible—outside of theological discussions—to find words for a few extraneous paragraphs that would so defraud our science.

If one could subtract the emasculated biology taught from such texts in 1935 from the total for 1935, how would the amount of zoology taught now compare with that in 1905? Some of the zoological text-books of thirty years ago may have been dry; but they were not rotten.

Our excursionary effort here is to learn why biological science has not obtained and maintained its proper place in our schools, and why great biologic truth is so little possessed by our people. We have yet to search the motivation of those several instances of state laws which prohibit the teaching of evolution. In any consideration of this matter it is unquestion-

able that it was traditional religion that thus invoked the heavy hand of legislation. It is equally clear that elsewhere, without invoking the law but with its extended and varied influence, traditional religion is now effecting a wide-spread repression of the teaching of this central principle of biology in public schools through the United States and in practically all other civilized countries as well. In this country it sometimes forces the resignation of able zoologists even from college positions; and in high schools and late primary grades there are probably to-day few places where straightforward teaching of the unmitigated evolution principle can be done except at the peril of the teacher. It is obvious that an eviscerated straw-man is set up in place of the reality for the younger students of denominational and parochial schools everywhere. In this country this means that many millions of our present and future citizens are robbed of a biological outlook, or they get one that is warped and unrecognizable, through direct responsibility of the church; while with somewhat less directness the same agency widely exercises a restraint upon effective biological teaching in the public schools.

Biologists in nearly all countries, and particularly in our own, have tried a compromise with religious creeds. That compromise has failed. Most youth of 1935, like those of 1859, leave our schools without having opportunity to learn that the worthy facts concerning man's origin and destiny come not from religious traditions but from biological investigations made within the time of men now living. That compromise now robs most modern youth of opportunity to learn what is known concerning his or her place in nature. In what is said here I am not concerned with the question whether religion is important; nor whether one or another of the creeds of the earth has or has not sufficiently "adjusted" its teachings to modern knowledge; nor whether one or another of them is good, bad or quite indifferent. But whatever the answer to those questions the present restrictive influence of organized religion on the teaching of the best of biology is intolerable. Such an influence, from whatever source, is too highly harmful and dangerous to the well-being of man—to modern beehive aggregations of men who live under ever multiplied rules and laws which must wreck us if based on variegated tradition instead of upon a common knowledge. For moribund traditional beliefs to continue to exercise such influence over the educational program of a country is a confession and declaration either of the apathy, the cowardice, the impotence or the intellectual bankruptcy of enlightened leadership in that country.

It is here that we meet "the confusion of tongues." A hundred years of a germ of truth, or seventy-six years since its bloom in publication, has either catalyzed or attended a very wide-ranging body of facts relating worthily to the nature, origin and destiny of man. That body of facts is well known to a few and, as dimly or partly known, is accepted and welcomed by many; but by many others this prime accomplishment of our science is either rejected outright, or its essentials are first thoroughly eviscerated and the husks then accorded an obscure corner in the attics of tradition. The tongues of the traditionalists are heard not merely from pulpits, but they echo also within our schools—the only possible home of science—and there they now curb or tie the tongues of biologic truth.

This confusion is partly sustained—or at least the voices of tradition are prolonged and made more plausible—by the words of great authorities in one or another branch of learning. To-day, as at Oxford in 1860, a professor can easily be had to support a bishop against a really good and far-reaching biological advance, where this impinges on traditional beliefs. The public can not fix relative values to the words of different scientific men. The biologist who has learned the texture and ways of living stuff knows well enough, however, that when renowned physicists and astronomers elect to speak about life, they really do this as laymen—and all too frequently their words are unconsciously filled with tradition, a thing which they also acquired as laymen. In addition to these volunteer voices from quite outside life-science, we are all aware that some high authorities in one or another branch of biological science persistently ignore the greater biologic accomplishment, and on some points they too still speak with tongues of a day that is gone. We may as well have it out with them.

In conclusion, it is here suggested that no one need espouse intellectual sterility because many and important mysteries still attach to the living world. The task of serious biological analysis—the thrust of observation and experiment against assumption and tradition—was begun only yesterday; and, very unfortunately and quite inexcusably, it is not until an unseen to-morrow that even 1 per cent. of mankind will become conscious of as much as 10 per cent. of the quite important mysteries which a sharp attack has already swept away. The issue to-day is on the question whether our educational facilities and practise will permit eager youth to examine the results of man's scientific efforts to learn man's own nature and man's place in nature; whether ignorance of many fundamental and now satisfactorily appraised biological phenomena shall continue to foster divergent and irreconcilable thought among great biological human populations which must live together; whether the case and the course of civilization is to be guided by knowledge or by the dead hands of the past; whether

the biological investigator of either yesterday or today may be permitted to give his best results to the world or whether he is to be more and more insulated by his own progress; whether, indeed, present man-in-the-mass has evolved sufficiently to prefer light to twilight, truth to tradition. Certainly until this issue has been definitely decided every zoologist will feel sure that mankind is worthy of much more than his very best efforts; but he, along with all other enlightened men, must find, recognize and overcome those forces which now obstruct the release of his best prizes to present generations of man.

SCIENTIFIC EVENTS

RESOLUTIONS PASSED BY THE SIXTH INTERNATIONAL BOTANICAL CONGRESS

AT the sixth International Botanical Congress meeting in Amsterdam from September 2 to 7, the two following resolutions were passed:

It is proposed that the Botanical Section of the International Union of Biological Sciences should act as an administrative connecting link between the successive International Botanical Congresses, which maintain their full independence from an international point of view to such an extent that any country which has not joined the union will have quite the same rights as those which have joined. It is proposed that this Botanical Section be authorized to carry through any resolutions, carried by the International Botanical Congresses.

By reason of the growing financial difficulties and the prohibitive price, for certain museums and laboratories, of transmission by post, rail and boat, it becomes impossible to guarantee the indispensable exchange of collections of dried plants. It is therefore necessary to obtain for this exchange the free transport now accorded to the exchange of scientific publications. The congress asks the Office of the International Union of Biological Sciences to take the necessary steps with various governments in order to obtain this postal privilege.

The following resolution was passed in memory of the late Hugo de Vries:

The Sections of Genetics and Cytology of the Sixth International Botanical Congress take the occasion of their presence in Holland to record the deep sense of debt which the sciences of genetics and cytology owe to Hugo de Vries. It is a satisfaction that he could live to such a ripe old age and thus see imposing structure which has been erected on the foundations in the laying of which his painstaking investigations and prophetic vision had so large a share. The honorary secretary of the congress is hereby requested to spread this resolution on the minutes of the *Proceedings* and to send a copy to Mrs. de Vries with the sympathy of the congress and with the assurance that Hugo de Vries will remain for all time an inspiration to biologists and live as one of the immortal heroes of science.

APPROPRIATION FOR SCIENTIFIC RESEARCH IN THE FEDERAL BUDGET

IN a statement copyrighted by Science Service it is reported that funds for scientific research by the federal government will be increased by about $5,000,000 during the fiscal year starting next July if the allotments in President Roosevelt's budget are followed by the Congress in making appropriations. Part of this increase represents a transfer of items from the emergency budget and part new funds under recent special legislation.

The Department of Agriculture receives most of the $5,000,000 increase with an estimated $3,500,000 more to devote to research than was available last year. New agencies will absorb the larger share of this. First there is the Soil Conservation Service, provided for by new legislation last April, which will receive $2,250,000.

Then there is a special research fund provided for by the Bankhead-Jones Act of June 29, 1935, under which $400,000 will be administered. Funds made available through the operation of this act have already enabled the initiation of nearly forty research projects on fundamental problems in biology, chemistry, meteorology and economics that have more or less direct bearing on agriculture.

The Beltsville, Md., research center will use about $50,000. The Forest Service will receive an estimated extra $300,000. But this amount is less than the emergency funds now available for research purposes that will probably be withdrawn or curtailed next year. The $100,000 allotted for forest products investigations is mainly for the Forest Products Laboratory. This amount, unless augmented by other funds, will not be sufficient to maintain the laboratory in its present running order. Other increases will enable some of the regional stations to maintain or slightly enlarge their regular staffs, but these increases are based upon specific projects and must be used for them.

The Bureau of Chemistry and Soils receives about $150,000. Of this, a part is for a new program of research provided for by the Congress on discovering industrial uses for farm products, but the major part is to be used toward the completion of the national soil survey.

The Public Health Service will get about $1,350,000 more for research than their funds for the present year. This represents the funds provided for by the social security legislation.

The Coast and Geodetic Survey will receive about

$240,000 more next year, but this again will probably replace emergency funds.

The National Bureau of Standards will receive $52,000 more under the proposed budget than the present year's appropriations. None of this will be available for scientific research, however. The bureau must do a certain amount of routine testing of materials, instruments and so on, and the new funds will provide for an increase in this work and for some necessary improvements in the plant.

The total amount for scientific research and the administration of scientific bureaus and offices comes to about $42,000,000 for the fiscal year 1936–1937. This is more than has been spent for this purpose in recent years, but it represents only about six tenths of one per cent. of the total budget.

THE WASHINGTON AWARD OF THE WESTERN SOCIETY OF ENGINEERS

DR. CHARLES FRANKLIN KETTERING, vice-president of General Motors Corporation in charge of research, Detroit, has been elected to receive the Washington Award of the Western Society of Engineers for 1936 for his "pre-eminent services in promoting the public welfare through his outstanding contributions to the increase of personal mobility and his driving force for the cause of research as an instrument to increase the welfare and happiness of all mankind." The award will be formally presented to Dr. Kettering at a dinner to be held in Chicago on February 27.

The award, founded by Mr. Alvord in 1917 and first conferred in 1919, is given annually—when deserving candidates are found—by the Washington Award Commission as "an honor conferred upon a brother engineer by his fellow engineers on account of accomplishments which pre-eminently promote the happiness, comfort and well-being of humanity." The commission is composed of eighteen members, representing five great engineering societies of the United States, namely: The American Society of Civil Engineers, The American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, The American Institute of Electrical Engineers and the Western Society of Engineers.

The recipients of the award since its foundation are as follows:

1919—Herbert C. Hoover, "for his pre-eminent services in behalf of the public welfare."

1922—Robert W. Hunt, "for his pioneer work in the development of the steel industry and for a life devoted to the advancement of the engineering profession."

1923—Arthur N. Talbot, "for his life work as student and teacher, investigator and writer and for his enduring contribution to the science of engineering."

1926—John Watson Alvord, "for his pioneer work in developing the fundamental principles of public utility valuation and his marked contributions to sanitary science."

1927—Orville Wright, "for fundamental scientific research and resultant successful airplane flight."

1928—Michael Idvorsky Pupin, "for devotion to scientific research leading to inventions which have materially aided the development of long distance telephony and radio broadcasting."

1929—Bion Joseph Arnold, "for pioneering work in the engineering and economics of electrical transportation."

1930—Ralph Modjeska, "for his contribution to transportation through superior skill and courage in bridge design and construction."

1932—William David Coolidge, "for his scientific spirit and achievement in developing ductile tungsten and the modern x-ray tube."

1935—Ambrose Swasey, "for his distinguished contributions as a builder of instruments, institutions and men."

The winner of the award is presented with a suitably inscribed bronze plaque mounted upon a marble base.

THE NEW YORK THEODORE ROOSEVELT MEMORIAL

THE New York Theodore Roosevelt Memorial was dedicated on January 19, with addresses by the President of the United States and other distinguished speakers. The program was as follows:

"America," led by Boy Scouts of America.
Tribute from the Nation, Franklin D. Roosevelt, President of the United States.
Report for the Board of Trustees, Mr. Kiernan.
Dedication of Memorial and Presentation to the City of New York, Herbert H. Lehman, Governor of the State of New York.
Acceptance of Memorial and Delegation of its Administration to Trustees of The American Museum of Natural History, Fiorello H. La Guardia, Mayor of the City of New York.
Guiding Principles for Memorial Administration, A. Perry Osborn, Trustee, The American Museum of Natural History.
"The Battle Hymn of the Republic," Roland Hayes.
Appreciations, Theodore Roosevelt, Jr.
Address, James R. Garfield.

In the course of his address the President said:

It is fitting that this memorial perpetuating the life and work of one who stirred such great interest in the field of natural history should itself be an adjunct of the American Museum of Natural History. And may I say that I am very proud of the fact that for forty years I have been a member of this museum. My friend, and our friend, the late Professor Henry Fairfield Osborn, so long the head of this noble institution for the increase and diffusion of scientific knowledge, and for many years a

devoted colleague of him in whose honor we are gathered to-day, advocated this memorial soon after Theodore Roosevelt's death. Each and every one of us feels sadness to-day that Professor Osborn could not have lived to take his part in this, the culmination of this great desire; we know that his spirit is with us.

The Roosevelt Memorial, which is a New York State undertaking in which the city and private individuals have cooperated, was first advocated by Professor Osborn soon after Theodore Roosevelt's death on January 6, 1919. In 1920 the Legislature appointed a commission to investigate and to make an appropriation.

Ground was broken on October 16, 1929, and the cornerstone was laid on October 27, 1931. The building has been under construction ever since, but numerous delays were encountered because of construction difficulties and because additional appropriations were slow in forthcoming. Up to the present $3,687,000 has been appropriated.

The structure is practically completed, although there are a number of unfinished details which are expected to cost about $100,000. One thing lacking is the large equestrian statue of Roosevelt with two accompanying figures on foot, one an American Indian and the other a native African. This statue, the work of James E. Fraser, will occupy a dominant position in front of the memorial entrance.

ATLANTIC CITY ADOPTED AS MEETING PLACE OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE FOR DECEMBER, 1936

AT the close of the Saint Louis meeting certain affiliated societies expressed the opinion that they had reason to believe that the change from March to January for the assembling of the new Congress and the inauguration of the President would interfere with holding a successful meeting of the association in the Capital City in December, 1936. This view was presented in person to the chairman of the executive committee and the permanent secretary by secretaries or representatives of several prominent affiliated societies.

The matter was immediately taken up in Washington with the chairman of the local committee, the representatives of affiliated societies in Washington and others involved in the question.

After an exchange of telegrams with members of the executive committee, the chairman authorized the Washington members to check further the situation in that city, study possible solutions of the difficulty and present their recommendations. This was done in the following form:

Careful consideration has been given to all aspects of the problem. Local members of the executive committee had also a conference with Dr. E. B. Wilson, who was in Washington on other business and took time enough to go over the situation fully. It was unanimously agreed that a successful meeting in Washington could not be assured for December, 1936.

It was further agreed that a joint meeting between Washington and Baltimore was not feasible, since the plan would resolve itself inevitably into two separate gatherings.

Finally, it was unanimously agreed to recommend that a meeting be intercalated in our series to care for the emergency.

It seemed likely that of all places mentioned Atlantic City had the most favorable conditions for the prompt and effective assumption of an unexpected responsibility. Inquiry has resulted in the offer of a favorable contract for this plan. The local members have heard the proposal and discussed it in full. We favor its acceptance.

E. B. MCKINLEY
A. F. WOODS
HENRY B. WARD

The executive committee has voted in favor of these proposals, and notices are being sent out this week to officers of all associated societies. The ample accommodations offered by Atlantic City will enable the association to furnish each organization with conditions that are especially desirable for its particular needs. The permanent secretary's office will be glad to receive information from all regarding their wishes.

HENRY B. WARD,
Permanent Secretary

SCIENTIFIC NOTES AND NEWS

AT a recent meeting in New York of the board of directors of the American Chemical Society, Dr. James F. Norris, professor of organic chemistry at the Massachusetts Institute of Technology, completed eleven consecutive years as director of the American Chemical Society. For two years he was a member *ex-officio* by virtue of his presidency of the society. Since then he has twice been reelected. A luncheon was tendered by the directors in honor of Dr. Norris and he was presented with a brief case by those in attendance "as a testimonial for long and faithful service."

DURING the annual meeting of the Society of American Bacteriologists in New York City a reunion luncheon was held in honor of Professor Leo F. Rettger. A group of fifty graduates and present students in the department of general bacteriology of Yale University participated.

DR. KNIGHT DUNLAP, who next month leaves the Johns Hopkins University to accept a professorship of psychology at the University of California at Los Angeles, was the guest of honor at a dinner of former graduate students held in Baltimore on January 11. Dr. Dunlap graduated from the University of California in 1899 and taught there from 1902 to 1906, when he accepted a call from the Johns Hopkins University.

DR. CHAUNCEY D. LEAKE, professor of pharmacology at the University of California, was elected president of the History of Science Society at the annual meeting held in St. Louis in January. Dr. Leake will fill the unexpired term of Dr. C. A. Browne, ending in December.

DR. MARTIN HILL ITTNER, chief chemist for the Colgate-Palmolive Company, was, at the recent annual convention of the American Institute of Chemical Engineers, elected president. He will preside when the institute meets this year with the British Institution of Chemical Engineers in London.

AT a recent meeting of the directors of the American Chemical Society, Dr. Charles L. Parsons, of Washington, was re-elected secretary and business manager, and R. T. Baldwin, of New York, was again named treasurer. Dr. Robert E. Wilson, of New York, vice-chairman of the Pan American Petroleum and Transport Company, was chosen director-at-large for a term of three years. Dr. Arthur J. Hill, professor of organic chemistry at Yale University, and Dr. Frank C. Whitmore, dean of the school of chemistry and physics of Pennsylvania State College, were named regional directors for the eastern states. Councilors-at-large were chosen as follows: Dr. James Bryant Conant, president of Harvard University; Dr. Gustav Egloff, chief chemist, Universal Oil Products Company; Dr. John Johnston, director of research, the U. S. Steel Corporation, and R. Norris Shreve, professor of chemical engineering, Purdue University. Alden H. Emery, assistant chief engineer of the Experiment Stations Division of the U. S. Bureau of Mines, was appointed assistant manager, a newly created office.

AT its annual meeting held in New York City from December 26 to 28, the Society of American Bacteriologists elected the following officers and councilors-at-large: *President,* Thomas M. Rivers, the Rockefeller Institute for Medical Research; *Vice-president,* James M. Sherman, Cornell University; *Secretary-treasurer,* I. L. Baldwin, University of Wisconsin; *Councilors-at-large,* Oswald T. Avery, the Rockefeller Institute for Medical Research, and Stuart Mudd, University of Pennsylvania.

THE Northwest Scientific Association held its annual meeting in Spokane, Wash., on December 27 and 28. President W. A. Rockie, of the Soil Conservation Service of Pullman, arranged a special symposium on problems of conservation in the Northwest with particular reference to soils. Eight section programs were held. The total number in attendance was about 225. The officers for 1936 are: *President,* J. W. Hungate, department of biological science, State Normal School, Cheney; *Vice-president,* C. W. Hungerford, vice-director of the Experiment Station, University of Idaho; *Secretary-treasurer,* O. W. Freeman, department of science and mathematics, State Normal School, Cheney.

THE annual meeting and banquet of the Torrey Botanical Club was held at Columbia University on the evening of January 6. Dr. Tracy E. Hazen, the retiring president, delivered the annual address on the organization, aims and progress of the club. The following officers were elected for the coming year: *President,* Marshall Avery Howe, director of the New York Botanical Garden; *Vice-presidents,* Henry Allan Gleason and Frank Earl Denny; *Secretary,* John S. Karling; *Treasurer,* Edwin B. Matzke; *Assistant Treasurer,* Mrs. James W. Marvin; *Editor,* M. A. Chrysler; *Bibliographer,* Mrs. B. O. Dodge, and *Business Manager,* Michael Levine.

DR. KENNETH K. LANDES, professor of geology at the University of Kansas and assistant state geologist, was recently elected grand vice-president of Sigma Gamma Epsilon, the professional fraternity for geologists, metallurgists, miners and ceramists. The fraternity was founded at the University of Kansas in 1915, and has grown to be a national organization of thirty chapters.

THE School of Medicine of the George Washington University announces the addition of the following professorial lecturers in preventive medicine to the faculty of the newly established curriculum in public health teaching: Dr. George W. McCoy, Dr. Rolla E. Dyer, Dr. Edward Francis, Dr. Charles Armstrong and Dr. Robert Olesen. Other recent additions to the faculty include: Dr. Ralph W. Barris, assistant professor of anatomy, and Dr. Daniel J. Sullivan, instructor in neurology.

DR. WILLIAM J. HUMPHREYS, meteorological physicist in the U. S. Weather Bureau since 1905, who retired on December 31, after thirty years of active service, has become a collaborator of the bureau. Under a special arrangement, he will now devote his time to research and writing on subjects in which he is most interested and to the solution of technical problems referred to him by the bureau.

DR. P. A. TESCHNER, of Milwaukee, since 1926 a member of the medical staff of the Wisconsin Anti-Tuberculosis Association, has been appointed assistant director of the Bureau of Health and Public Instruction of the American Medical Association. This is a newly created position to take care of the expanding work of the bureau.

DR. J. FRANKLIN YEAGER has been appointed entomologist in the Division of Control Investigations, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, and is stationed in the new laboratory of the bureau at the National Agricultural Research Center at Beltsville, Md. Since 1931 he has been associate professor of physiology at the Iowa State College. At Beltsville he will continue his investigations on the physiology of insects.

MISS FLORENCE FALLGATTER has been appointed chief of the home economics education service in the vocational division of the Federal Office of Education. She succeeds Dr. Adelaide S. Baylor, who retired in October and who recently died.

DR. T. H. GOODSPEED, leader of the botanical expedition to the Lower Andes of the University of California, has reported that a collection of 2,000 herbarium specimens has so far been made during the trip. Dr. Goodspeed has given lectures before the American Club of Peru, the University of Chile, the Scientific Society of Santiago and the Museo National de Historia Natural in Chile.

ACCORDING to an Associated Press dispatch, Dr. Arthur H. Compton, professor of physics at the University of Chicago, planned to leave on January 18 to install a cosmic ray meter aboard the steamer *Orangi* as one phase of the observations which will be conducted in various parts of the globe. He will accompany the meter on the *Orangi* as far as Honolulu, boarding the ship again on its return trip from Sydney.

THE College of Natural Science of Yenching University at Peiping, China, reports that leave of absence for the year 1935–1936 has been given to Professor Wm. H. Adolph, of the department of chemistry, who is visiting professor of biochemistry in the Medical School of Yale University; to Professor W. W. Davis, of the department of mathematics, who is studying at the University of Chicago, and to Professor J. C. Li, of the department of biology, who is continuing his work on Drosophila in Professor T. H. Morgan's laboratory, at the California Institute of Technology.

DR. EDGAR ALLEN, professor of anatomy at Yale University, delivered the third annual Harry Hayward Charlton Memorial Lecture in Anatomy at the University of Missouri on January 6. Dr. Allen spoke on "The Escape of the Egg from the Ovary." The lecture was illustrated with slides and moving pictures.

DR. W. J. HUMPHREYS, of the U. S. Weather Bureau, spoke on January 7 before the Lancaster Branch of the American Association for the Advancement of Science. His subject was "Fogs and Clouds."

DR. A. E. ALEXANDER, of the Buffalo Museum of Science, addressed on January 13 the Rochester Academy of Science on "What the Buffalo Museum is doing to Interest the Layman in Mineralogy."

DR. PHILIP BARD, of the department of physiology of the Johns Hopkins University, gave the fourth Smith-Reed-Russell lecture at the School of Medicine of the George Washington University on January 16. The subject of his address was "The Neural Bases of Certain Forms of Emotional Expression."

DR. R. S. MULLIKEN, professor of physics at the University of Chicago, recently delivered a series of lectures at the California Institute of Technology on the general subject of "Electron States and the Structure of Molecules."

DR. REUBEN L. KAHN, assistant professor of bacteriology at the School of Medicine of the University of Michigan, will present a course of lectures at the Academy of Medicine, Atlanta, on January 27, 28 and 29, under the auspices of the Atlanta Clinical Society. He will discuss "Tissue Immunity and Clinical Medicine."

DR. SVEN INGVAR, professor of medicine in the University of Lund, Sweden, delivered the Hunterian lecture on January 20. He spoke on "The Physical Basis of Psychoneurosis." The Hunterian Oration on "John Hunter's Time and Our Own Times" will be delivered by Sir G. Lenthal Cheatle on February 24.

THE Federation of American Societies for Experimental Biology, which includes the American Physiological Society, the American Society of Biological Chemists, the American Society for Pharmacology and Experimental Therapeutics and the American Society for Experimental Pathology, will meet in Washington, D. C., on March 25, 26, 27 and 28. The Hotel Willard and Hotel Washington will serve as headquarters. All scientific sessions, except the demonstrations on Friday afternoon, March 27, will be held in these hotels. The demonstrations will be held at the National Institute of Health. Dr. E. B. McKinley, of the School of Medicine of the George Washington University, is chairman of the local committee.

THE winter convention of the American Institute of Electrical Engineers will be held from January 28 to 31 at the Engineering Societies Building, New York.

The Edison medal for 1935 will be presented to Dr. Lewis B. Stillwell on Wednesday evening, January 29. After the presentation, a lecture on astronomy will be given by Dr. Harlow Shapley, director of the Harvard College Observatory. In addition to the long list of technical papers, symposia are planned on magnetic materials and on the modernization of distribution systems. Friday will be devoted to inspection trips, and visits have been planned for the other days of the convention in such a way as to supplement the technical sessions.

OFFICERS for the Sixth Midwest Power Engineering Conference, which will meet from April 20 to 24 at Chicago, are the following: *President,* F. D. Chase, Chicago; J. R. Van Pelt, *chairman;* O. A. Anderson, Frank Innes, J. E. Kearns, G. E. Pfisterer and K. A. Auty, Chicago. The conference will be sponsored as before by the local sections and regional divisions of the following societies: the American Institution of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Edison Electrical Institute, the Western Society of Engineers, the National Safety Council and the American Society of Refrigerating Engineers. Official hotel headquarters will be at the Palmer House, where the entire fourth floor has been reserved for meetings, lunches and receptions. Afternoon sessions will be held at the International Amphitheater, where the Midwest Power Show will be held. Meetings are open to all persons interested, regardless of membership in the sponsor societies, but participating members must conform to registration rules.

THE second Congress of the International Society of Microbiology will be held in London from July 25 to August 1. University College, Gower Street, London, W.C.1, will be the headquarters and all scientific sections will be held there; additional accommodations, if required, will be available in the adjacent buildings of the London School of Hygiene and Tropical Medicine and the Wellcome Research Institution. The president of the executive committee is Professor J. C. G. Ledingham; the honorary general secretary is Dr. R. St. John-Brooks, both of the Lister Institute. A preliminary program has been issued which may be obtained from the honorary general secretary, Second International Congress for Microbiology, Lister Institute, Chelsea Bridge Road, London, S.W.1, England. All those interested in microbiology may become members of the congress on payment of a subscription of five dollars. Prospective members are urged to register early. Dr. Karl Landsteiner, Rockefeller Institute for Medical Research, is president, and Dr. Malcolm H. Soule, University of Michigan, is secretary, of the American National Committee.

DISCUSSION

THE DAVID EUGENE SMITH GIFT OF HISTORICAL-MATHEMATICAL INSTRUMENTS TO COLUMBIA UNIVERSITY

THE rather wide publicity recently given by the press to my gift to Columbia University has led to a request that I give a brief summary of the items presented.

A few years ago I gave to the university my library on the history of mathematics, consisting of upwards of 20,000 items—bound volumes, manuscripts, portraits of mathematicians (about 2,700 engravings and 160 medals), catalogued monographs (2,000) and 4,000 letters, including such leaders as Newton, Descartes, Leibniz and the Bernoullis. For use in my lectures I had, over a period of more than 40 years, collected more than 275 instruments of early and medieval times for purposes of calculating, measuring (lengths, areas, volumes, weight and time) and astronomy (navigation, astrology, and the calendar). It therefore seemed appropriate that this historical-mathematical material should be placed alongside the books, many of which describe and illustrate the instruments themselves.

Among the most interesting pieces the following may be mentioned:

Representing numbers: tally sticks beginning with those of the thirteenth century; early Greek alphabetic numerals of the Ptolemaic period on an ikosahedral die; several pieces of papyrus with coptic numerals; several hundred medieval parchments containing numerals; and a few knotted cords and prayer beads from the orient.

Operations with numbers: sets of counters used on a computing table; various forms of the abacus (Chinese, Japanese, Armenian, Russian and Western European); and a cast of an early Greek computing table now in Athens.

Number games: dice of various types and periods from Etruscan, Egyptian, Greek and Roman times through the medieval period.

Measures: length (rods showing the ell, cubit and other units); weight (numerous nests of brass weights, some sealed officially and interesting as works of art; various forms of the steelyard; money-changers sets from various countries); angles (proportional compasses of the Roman period, ordinary compasses—also Roman, and various types from the renaissance

period, some with the names of prominent makers; various types of protractors.

Measures of time: sundials of various countries and eras. Those of China are often works of art, being engraved with great care. Most of the various types of sundials are shown. These are in ivory, bronze, silver or wood. Two Japanese clocks of curious mechanism are included.

Instruments of surveying and navigation: These include several remarkable astrolabes beginning with one of the sixteenth century. There are also a number of early quadrants and other instruments in copper and in brass. In general they were secured in Italy, Germany, India, Austria, Iraq, Arabia and France.

Astronomical instruments, including those above mentioned and a number of brass armillary spheres (some of artistic merit) and celestial spheres of brass with the important stars inlaid in silver. These were secured in northern India about thirty years ago. One of them bears the inscription, dated 1645, stating that it is the work of the grandson of the emperor's chief astronomer.

These instruments represent the elementary and utilitarian phase of mathematics. The university already had a large collection of modern geometric models, chiefly of European origin.

DAVID EUGENE SMITH

SOURCE OF PROPULSIVE POWER USED BY FLYING FISH

SEVERAL references have appeared in recent months relative to the method of flight used by flying fishes. In all of them the consensus of opinion seems to be that the flight in itself is purely a glide, with no generation of new motive power once the fish has cleared the water. This is not strictly true.

On a recent hundred-day voyage, mainly through tropical waters, I became interested in their source of motive power and spent literally hours of my leisure time watching the take-offs and flights. Eye analysis of the motions is of course not so reliable as would be possible with a moving picture camera, but on one point the eye does not deceive. These fish, as they leave the surface of the water, do actively lash the water with their tails, and at this time there is a synchronous movement of the wings. Whether the wing movement adds impetus or is purely secondary to body movement of the tail lashing is impossible to say. The point I wish especially to contribute is that these fish, after the take-off, may again and again lower the tail into the surface of the water and lash it violently to gain impetus for continuation of their flight. The entire body does not enter the water; only the tail is lowered by a backward tilting of the whole. I watched this act of renewing impetus numberless times, often seeing it repeated four or five times in the course of a single flight. Naturally it can be observed only when the sea is quite calm.

The flying fish flight, then, is often not simply a sustained glide, but may be a series of glides interrupted by brief periods of tail lashing on the surface of the water for gaining additional impetus. The tail lowering appears to be intentionally performed when the body approaches close to the water surface.

C. A. MILLS

UNIVERSITY OF CINCINNATI

THE DEPOSITS OF HAYDEN VALLEY IN YELLOWSTONE NATIONAL PARK

YELLOWSTONE RIVER flows north from Yellowstone Lake through a broad depression known as Hayden Valley. The floor of this depression, about 25 square miles in area, is covered with deposits which are mapped in the United States Geological Folio for Yellowstone Park (No. 30) as glacial drift. De Martonne accepted the material as moraine in discussing movements of ice in this area.

In a survey made during the summer of 1933 by the writer in company with Professor Douglas Johnson, of Columbia University, some doubt was raised regarding the earlier identification of the deposits. These doubts were founded on: (1) the well-integrated drainage prevailing in the supposed morainal area, coupled with the fact that the few shallow depressions which do appear are associated with a topography suggestive of slumping; (2) the presence of horizontal bedding revealed in some of the hill slopes and the exposure of laminated silts and clays in holes dug by burrowing animals; (3) the general absence of large boulders. The hills are mantled by loose cobbles and gravel which creep down the slopes and mix with wash from the underlying silt and clays. The superficial resemblance of the resulting material to till probably accounts for its earlier misidentification.

New road cuts in Hayden Valley show that the rolling moraine-like hills are composed largely of finely laminated or varved clays and clay-silts. These unquestionably lacustrine sediments pass downward into fluvial or glaciofluvial sands and gravels which form the basement deposits of the hills.

Recognition of the lacustrine origin of all but the lowest sediments has led to a new conception of the Pleistocene history of Hayden Valley. Details of the history will be discussed in a comprehensive report on the geomorphic development of the Grand Canyon of the Yellowstone River. This study represents one phase of the Big Horn-Beartooth-Yellowstone Project and is supported in part by grants from the Geological Society of America.

ARTHUR DAVID HOWARD

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CRISIS UNDER WATER

THE rare aquatic phenomenon described by Mr. David Tomlinson in the November 1 issue of SCIENCE should be of considerable interest, if our interpretation of it is correct. We have seen at intervals precisely the same thing happen in a small indoor concrete aquarium which we keep supplied with rain water because of the high sodium carbonate content of our tap water. From time to time the water in this aquarium assumes a curiously dead appearance due to the sinking of the algae and the accumulation of organic stain; vascular plants look unthrifty, and the fish gather at the top gasping for air. When this condition occurs it can be remedied almost immediately by dumping a small amount of crushed and powdered limestone into the water. It is even possible to predict the arrival of critical conditions some time in advance, and no doubt this could be done in large reservoirs, thus forestalling the destruction of fish. Our surmise is that the phenomenon represents, in miniature, what happens during the transition of a dying lake from the eutrophic or rich mineral condition to the oligotrophic or depauperate mineral condition, which leads to the formation of an acid bog. In the case reported by Mr. Tomlinson, it would be very interesting to know whether the cumulative development of aquatic life had not sequestered most of the soluble alkaline minerals by the time the unsettled weather conditions of which he speaks made their appearance.

If this explanation is correct the real trouble was due to the inability of the algae to remain alive and release oxygen and only in a secondary sense to the mass decay of organic matter. Although the concept of mineral nutrition as a governing factor in bog formation is well understood in this country to-day, it is absent from so much of our literature on peat that it seems proper to emphasize what appears to be a vivid example of it.

P. B. SEARS

UNIVERSITY OF OKLAHOMA

SCIENTIFIC BOOKS

HISTORICAL GEOLOGY OF THE ANTILLEAN-CARIBBEAN REGION

Historical Geology of the Antillean-Caribbean Region or The Lands Bordering the Gulf of Mexico and the Caribbean Sea. By CHARLES SCHUCHERT, D.Sc., LL.D., professor emeritus of paleontology in Yale University. Published by John Wiley and Sons, 1935. 811 pages, 16 plates, 107 figures.

VERILY as time goes by and brings before us new scenes of ancient life and earth development our primal interests change—hobbies become occupations; avocations become vocations.

We have before us a monumental work by one primarily interested in brachiopod classification and structure. Interest in environmental relations, origin, routes of migration, geographic distribution of life forms led the author into paleogeographic studies of the North American continent. Since fossil faunas seemed frequently to have been derived from the South, through what portals did these immigrants pass, how wide, how deep, and what restriction to such immigration did nature impose? With the zeal of the Renaissance enthusiast unearthing the literature of ancient Greece and Rome, examining and translating every newly found document and interviewing every traveler returning from these classic lands, this author has spared no pains in gathering up all relevant literature, be it the printed page, map, section, diagram or chart or even the portrait of each noted worker. He has corresponded at length with those now living and has solicited many a personal interview. Data so obtained have been carefully credited to their proper sources; analyzed for their bearing on the various phases of the work in hand, and finally assembled for proper deductions.

Naturally, no review in a few paragraphs can give anything like an adequate conception of the contents of this work. One might quite as well attempt to review the contents of a new edition of a large encyclopedia or dictionary. The scope of the work seems to have enlarged from an attempt to indicate the provenance of North American fossil faunas through a "Geological History of the Antillean Region" (1929) to this "Historical Geology of the Antillean-Caribbean Region, or Land Bordering the Gulf of Mexico and the Caribbean Sea." But even this extended title does not adequately convey an idea of the contents of this great volume (xxvi–811 pp., 16 pls., 107 figs.). From the title one would naturally expect to find the work given over to a statement of what is known of the systematic or historic geology of the areas concerned, somewhat after the style of the Correlation Bulletins of the U. S. Geological Survey some forty years ago. Instead, we find, for example, half of the "Summary" devoted to paleogeography and diastrophism—the latter containing such topics as "Late Cenozoic Epeirogeny (Antillean Revolution)," and "Probable Causation of Diastrophism." Neumayr and Lapparent might be surprised at the new uses being made of paleogeography, and Suess and Willis find their work meticulously checked and rechecked in this critical region. Historic geology has clearly become a far more embracing branch of science since the days of correlation bulletins.

Perhaps something of the details of this work may be gained from a glance at the table of contents, with supplementary annotations. The whole work is divided into four "Sections" (1, Introductory and Summary; 2, The Three Middle American Basins; 3, Biogeography; 4, The Lands) of which the last section is six times as large as all others combined. This is quite proper, as it contains the detailed data on which the general conclusions are based.

Section I is the "Introduction and Summary." One half of this, as already noted, is devoted to diastrophism and paleogeography. Elsewhere the section contains discussions of "The Antillean Geanticline or Protaxis"; "The Caribbee Volcanic Arc"; "The Panama Bridge," and the "Panama-Costa Rica, Tehuantepec Portals." Humboldt's primary concept of a mountain chain extending continuously from Alaska to Cape Horn was proven erroneous, so far as Central America is concerned, by the painstaking work of Karl Sapper and likewise in the Antillean region by Hill near the close of the past century. Structural features of Central America run mainly east-west but are often obscured by more recent deformations and volcanic phenomena. The Caribbean trough, the author regards as very old, probably pre-Paleozoic. Volcanic islands in Cretaceous times first partially or wholly closed the east and west ends of this trough.

"It is not alone because the Caribbean has oceanic depths that it is considered to be of very ancient origin. The main basis for this assumption is the fact that such a water-way is necessary to explain the distribution of the faunas since Silurian times, from Europe and North America into South America and in the reverse direction."

Regarding the origin of the Gulf of Mexico we read:

> One of the striking results of the present study is the confirmation of Suess's conclusion that the now very deeply sunken Gulf of Mexico, along with Florida and the Bahama Banks, is but part of an ancient "flat plate." . . . The subsiding of the Gulf of Mexico plate began as early as the middle Silurian, but was of a gentle, intermittent nature throughout the Paleozoic time. The effect of these subsidences is not apparent in the immediate area of the Gulf, but is clearly revealed in the marine faunas of the Mississippian depression. . . . The actual downbreaking of the Gulf of Mexico plate and the formation of the Gulf basin are believed to have begun with the gentle subsidence of late Jurassic time in western Cuba. . . ."

Section II, on the "Three Middle American Basins," treats in somewhat detail of the "Caribbean Mediterranean," the "Young Gulf of Mexico" and the "Antillean Sea" between these two.

Section III, "Biogeography," besides dealing with the distribution and relationships of fossil faunas, treats mainly of the occurrence and interrelationships of modern faunas and floras of the various land areas considered. Plants, snails, crayfish, reptiles, fishes, birds, mammals, etc., lead the author to conclude:

> With one exception, all the fourteen students of the life of the Greater Antilles whose work has been mentioned see in both the faunal and floral biotas unmistakable evidence for more or less migration via land from South America. These migrations took place, according to the present writer, at two widely separate times, the first during the Eocene, and the second, in a much more limited way, during the Miocene and early Pliocene. Nearly all biographers are agreed that the Antillean life (except birds) is predominantly Central American in character and that Central American life in turn is very largely of South American origin. . . . What the present work shows especially is that back of the Miocene, and more certainly back of the late Eocene, Central America was continued eastward into a very long, rugged Antillean peninsula, which appears to have been terminated with the Virgin Islands and Banks.

Section IV, the bulk of the work, is devoted to "The Lands." These are divided into seven regions: (1) Mexico; (2) Gulf Coast Plain; (3) Nuclear Central America; (4) The Antilles and Their Foreland; (5) Young Isthmian Link Connecting Central and South America; (6) Northern South America; (7) Oceanic Islands. To each of these regions are devoted from three to seven chapters. Samples of the contents of these chapters, chosen at random, are herewith outlined:

Chapter 11, Mexico. Seven primary structural features: Mexican geosyncline, Occidental geanticline, Llanoria, Southern Pacific geosyncline, Sonoran borderland, Balsas portal, Del Sur borderland. Physiographic and structural provinces: Sierra Madre Occidental province, Anahuac Desert plateau province, Sonora Desert province, Gulf Coastal plain province, Sierra Del Sur province, Volcanic province, Tehuantepecan province. Diastrophism: Paleozoic, Triassic, Late Jurassic, Lower Cretaceous, Upper Cretaceous Laramid Revolution. Late Pliocene-Pleistocene epeirogeny.

Chapter 21, Texas. Physiography, Structure: Fault zones, Barton syncline, Salt domes, whence the salt? Stratigraphic sequence.

Chapter 29, Larger structural features of the Antilles. General structure of the Antilles. Cenozoic crustal unrest. Direction of compression. The major faulting. Structure of the individual islands: Jamaica, Hispaniola, Puerto Rico, Virgin Islands—St. Croix, Cuba. Conclusion on Antillean structure.

Chapter 37, Panama. Notes on the geologic map by R. H. Terry. Volcanoes. Origin of the Panama land bridge: Physical evidence, Biogeographic evidence. Stratigraphic sequence, mainly along the line of the Panama Canal.

The large number of geologic, physiographic and paleographic maps, together with many well-chosen sections and diagrams, aid materially in making clear the author's conception of the development of this great sub-tropical belt of our Western Hemisphere. No attempt has been made to illustrate the faunas and floras upon which the greater part of geologic chronology and correlation is naturally based. Here as elsewhere, in using the vast amount of material assembled from others the author has accepted their work "at its face value" unless "contradicted by later work or not borne out by interregional correlation." The aid Dr. Schuchert has given us in interpreting American geology is clearly that of a Lyell, of whom Ramsay once remarked "We collect the data and Lyell teaches us to comprehend the meaning of them."

This work will at once assume an outstanding place in geological literature, and its value as a work of reference for decades to come can scarcely be overestimated.

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SPECIAL ARTICLES

NATURAL GLASSES OF THE INSOLUBLE RESIDUES OF THE PENNSYLVANIAN LIMESTONES OF TEXAS

DURING the course of some preliminary investigations of the insoluble residues of certain Pennsylvanian limestones of central Texas it was found that some of the formations contain a relatively conspicuous amount of fragments of natural glasses. This statement should not be construed, however, to mean that any large amount of the fragments may be found in these formations.

The method of investigation, during the progress of which such fragments were noted, was essentially that developed by McQueen[1] for the study of insoluble residues. In this method the rock is first crushed in a mortar and screened. Twenty-five to thirty grams of the material passed through the 8-mesh screen and retained on the 16-mesh are successively digested with 50 cc of 6 M hydrochloric acid until the sample ceases to show any effervescence. The residue remaining is then separated from the acid by decantation and washing or by means of an elutriator. It is then dried and is ready for examination under the microscope.

If the residue is small, which was generally the case with the rocks in question, a constituent may appear to be conspicuous, although in reality it composes only a small part of the original rock. This is the case with the natural glass fragments, which, because of their peculiar properties, are very easily noticed in such residues.

Appreciable amounts of natural glass fragments were noted in samples from a number of formations but particularly from the Marble Falls formation, Adams Branch limestone member of the Graford formation, and the Gunsight limestone member of the Graham formation.

Occurring in different formations with fairly wide separation in the geologic column these natural glasses are, therefore, manifestly of no value in geologic correlation, but it is thought that their presence is worthy of note, even though no practical application can be made.

The fragments vary in size from pieces measuring 0.736 mm × 0.480 mm and 0.928 mm × 0.352 mm to the very smallest of fragments.

Some pieces examined showed perlitic cracks and globulites. Conchoidal fracture is a conspicuous character. The isotropic nature of the material as shown under crossed Nichols is of course a conspicuous characteristic.

All the fragments studied for their refractive indices by means of immersion oils showed indices between 1.515 and 1.520.

George[2] has made a study of the relation of refractive indices of natural glasses to their chemical composition. Reference to George's curve of the indices of refraction and chemical composition indicates that these fragments have a chemical composition of approximately 65 per cent. silica.

No generalization from this study is attempted, except the notation that it probably indicates a more wide-spread distribution of natural glasses in such sediments than may generally be thought to be the case.

Fragments of natural glasses are more or less resistant to destruction during transportation and deposition so that their wide-spread distribution might be expected.

In sediments like sandstone a few fragments included among many pieces of insoluble material would not be noticed during an ordinary examination, while an equal distribution in limestone would be easily noted because of the greatly reduced residue.

The occurrence of the fragments in the formations noted is probably more related to the wide-spread distribution of this kind of material than to any fact of

[1] H. S. McQueen, "Insoluble Residues as a Guide in Stratigraphic Studies," Missouri Bureau of Geology and Mines, 56th Biennial Report, 1931.

[2] William O. George, *Jour. Geol.*, 32: 5, 353–372, July–August, 1924.

peculiar significance concerning the origin of these formations.

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TEMPERATURE CHARACTERISTICS OF THE "BERGER RHYTHM" IN MAN

RECENT work from several laboratories has shown that various groups of cells in the mammalian brain exhibit what appear to be "spontaneous" electrical activity, producing rhythmic waves of potential variations at characteristic frequencies. The most readily detectable of these rhythms (the "Berger rhythm") has been shown (Adrian and Yamagiwa)[1] to arise in a localized region of the occipital cortex. In man these occipital fluctuations of from 50 to 100 microvolts may be obtained when the subject is in a resting condition with the eyes closed by directly applying pad electrodes to the head. The waves from the occipital cortex of a resting human subject have been shown to occur at a remarkably constant frequency, about 10 per second. For a recent review of the literature dealing with electrical brain waves *cf.* Kornmüller, 1935.[2]

It is reasonable to suppose that the Berger rhythm may be due to relaxation oscillations resulting from continuous, entirely non-rhythmic metabolic events going on in the cortical cells. The frequency of the rhythm, therefore, might be expected to be directly proportional to the speed of these local metabolic events (*cf.* Hoagland).[3] To test this hypothesis I have examined the Berger rhythm as a function of temperature in subjects who were given hyperpyrexia treatments. The resources of the Physical Therapy Department at the Worcester State Hospital were made available through the kindness of Dr. Clifton T. Perkins and his technician, Miss Alice Sheahan. This paper is a brief preliminary report of the findings.

If the frequency of the rhythm were a direct measure of the velocity of determinative chemical events, the Arrhenius equation should fit the data. This equation may be conveniently used in the form

$$\text{Frequency} = k\,v = e^{-\mu/RT} + c$$

where v is the velocity of the underlying chemical mechanisms, e is the base of natural logarithms, R the gas constant, T the absolute temperature, k and c are constants and μ the critical thermal increment, or temperature characteristic, in calories per gram mol of activating energy of the reacting system.

The subject was placed on a bed, thoroughly wrapped to prevent heat loss, and his temperature elevated in most cases to 105.0° F. by passing high frequency alternating currents through his body. Rectal temperatures were taken every 15 minutes with a clinical thermometer during the 1½ to 2 hours that were necessary to elevate the temperature. In some experiments the rhythm was also recorded with descending temperatures. Immediately after recording each temperature the Berger rhythm was recorded continuously for some 50 seconds by means of an amplifier and ink-writing undulator recording on paper tape.

So far six subjects have been studied. Five of these were patients suffering from general paresis and the sixth was a multiple sclerosis patient, a professional man, entirely normal mentally, who comes to the hospital weekly for diathermy treatments. This last patient's temperature was not elevated above 102.0° F.

The Berger rhythm records in a given experiment were averaged for each temperature by obtaining the mean value of the number of oscillations per second for the 50 ± seconds during which each record was made. In this way mean frequencies to four figures were obtained of approximately 500 Berger cycles at each of some seven temperatures between the normal body temperature and the peak temperature. Since each of the general paresis patients receives a number of daily diathermy treatments it was possible to obtain an average of four complete sets of data from each one. Three experiments were performed with the non-resident patient. The experiments on a given individual were all done on different days. Some 70,000 Berger cycles were thus obtained as a function of temperature.

When the logarithms of the mean Berger frequencies for each patient were plotted against the reciprocals of the absolute temperatures, straight lines of negative slopes were found in all the experiments, indicating the adequacy of the Arrhenius equation to describe the data. The mentally normal patient and the least seriously affected of the five general paresis patients yielded mean μ values of 8,000 ± calories. Two of the other patients gave mean values of 11,000 ± calories, while two gave values of 16,000 ± calories. The Berger rhythm was found to be increased roughly from 9 or 10 to 13 beats per second for a rise of 6° F. (about 3.5° C.) in patients yielding this last value. The increase was, of course, proportionately less with the other patients. While it is possible that the higher values of μ may be related to the greater extent of cortical damage due to the disease, the data at present are obviously quite inadequate to warrant such a clinical generalization, although the continuance of the work has interesting possibilities along these lines. The magnitudes of the μ values are, however, very suggestive in that they are identical with those found re-

[1] E. D. Adrian and K. Yamagiwa, *Brain*, 58: 323, 1935.
[2] A. E. v. Kornmüller, *Biol. Rev.*, 10: 383, 1935.
[3] H. Hoagland, "Pacemakers in Relation to Aspects of Behavior." The Macmillan Company, New York. 1935.

peatedly by other workers to be associated with respiratory phenomena in cells (*cf.* Crozier[4] and[5]).

HUDSON HOAGLAND

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THE ISOLATION OF CRYSTALLINE TOBACCO MOSAIC VIRUS PROTEIN FROM DISEASED TOMATO PLANTS

THE isolation of a crystalline protein possessing the properties of tobacco mosaic virus has recently been described.[1] This protein was obtained from Turkish tobacco plants infected with this virus, by fractionation of the globulin in the plant extract with ammonium sulphate, celite and lead subacetate. The same general procedure with certain improvements[2] has been applied to extracts from tomato plants infected with tobacco mosaic virus and an active crystalline protein has been obtained from this host plant.

The protein from mosaic-diseased tomato plants and that previously isolated from mosaic-diseased Turkish tobacco plants have the same crystalline form, optical activity and chemical composition. They likewise give the same protein color reactions and are precipitated from solution under the same conditions. When solutions of the protein from diseased tomato plants are made more alkaline than about pH 11 or more acid than about pH 1, the protein is denatured and the virus activity is lost. It is completely coagulated and the activity lost on heating to 94° C. These results are similar to those obtained with solutions of active crystalline protein from diseased tobacco plants. Cataphoresis experiments, carried out by means of the Northrop-Kunitz apparatus, on the crystals obtained from tobacco plants and on those obtained from tomato plants show that the isoelectric point of each is about pH 3.2. At hydrogen-ion concentrations more alkaline than pH 3.2 the crystals from both sources migrate to the positive electrode, whereas at more acid reactions they migrate to the negative electrode.

No significant difference between the infectivity of protein from tobacco plants and protein from tomato plants was detected in several tests in which the half leaf method of inoculation was used. One cubic centimeter of a solution containing but 10^{-9} grams of the crystalline protein from either source has usually proved infectious. The crystalline protein from mosaic-diseased tomato plants, when present in solution at a concentration of 10^{-5} or more grams per cubic centimeter, gives a precipitate when mixed with the sera of animals previously injected with either the crystalline protein obtained from diseased Turkish tobacco plants or with the juice from such plants.

The isolation from a different host plant of a protein possessing the same physical, chemical and biological properties as those previously found for the protein from mosaic-diseased tobacco plants offers additional evidence for the identity of the protein with the agent responsible for the tobacco mosaic disease.

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[4] W. J. Crozier, *Jour. Gen. Physiol.*, 9: 531, 1925–26.
[5] W. J. Crozier, *Jour. Gen. Physiol.*, 7: 189, 1924–25.
[1] W. M. Stanley, SCIENCE, 81: 644, 1935.
[2] W. M. Stanley, *Phytopath.*, 26, No. 2, (Abst.), 1936.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

"KARO" AS A MOUNTING MEDIUM

IN recent years "Karo"[1] has been used as a mounting medium for zoological and botanical material by a number of investigators. It is a mixture of maltose, dextrose and dextrin.

The writer has found it useful for mounting algae. With delicate forms, it is necessary to concentrate the solution gradually, as in the glycerine jelly technique. Finally when the "Karo" is concentrated a hard mount is obtained which is as firm, and seems to be as permanent, as a balsam or damar mount. It is also useful in mounting pollen grains. The preparations are more permanent than those made with glycerine jelly, and the advantage of the glycerine jelly method is retained in that the grains, when so mounted, may be studied in their expanded condition. It is also a speedy, efficient medium for making whole mounts of insects. Clearing the animal, which is often a difficult process due to the presence of air in the tracheae, is not necessary. Animals which are mounted in "Karo" have a more natural appearance than those mounted in damar.

Ordinarily ringing the cover glass is not necessary. It is advisable only if the slides are exposed to very moist conditions or when thick whole mounts are made. The addition of a few crystals of Thymol or any preservative of this type prevents the growth of fungi, although fungi rarely develop, even when the preservative is lacking. "Karo" has the advantage over balsam or damar in that material may be mounted into it directly from water or the lower alcohols. Thus the hardening and shrinkage, which often occur with the use of alcohols and clearing agents, may be prevented. The sugars present do not crystallize. Slides which were made six years ago are still in perfect condition.

[1] "Karo" is a white corn syrup produced by the Corn Products Company.

An article describing the techniques employed in the use of "Karo" by various workers is being written.

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A SIMPLE COMPARATOR FOR ABSORPTION SPECTROGRAMS

THERE is here described a simple device for reading spectrograms with fair accuracy and with a minimum of fatigue. Instead of being viewed through a low power microscope, as is customarily done, the image on the photographic plate is projected on a ground glass screen.

The light from a 100 watt lamp (L) contained in a ventilated metal housing (V) is focussed by a condenser (C) on to the lens (R) which may be an ordinary rectilinear or anastigmat camera lens, and which is in turn focussed on the ground glass screen (G). Immediately in front of the camera lens is placed a totally reflecting right-angle prism (P) of good optical quality, large enough to cover the field. The plate to be read (S) is inserted in a slide (D) between the condenser (C) and the lens (R) in such a position as to be brought to a focus on the screen (G). The slide (D) moves on a double rack and pinion (Y, Z) device, whose shaft (I) supported by the flat springs (Sp) is connected to a flexible steel shaft (U) terminating with a knob (K). Directly behind the screen (G) is a thin vertical wire (W) whose shadow produces the hair line. This wire (W) is attached at the top of the frame in a fixed position, and at the bottom to a short spring (B) which keeps the wire taut. The other end of this spring is attached to a sliding member (E) having the horizontal spring (F) and the screw (H). Thus by turning the knob (M) the hair line is aligned with the wave-length scales at top and bottom projected from the plate. This is necessary since the plates vary slightly in size; the slide (D) must be made a trifle oversize, and the plates will not always be precisely square with the slide (D). A movable pointer (J), sliding on a square or rectangular metal rod (N) and having a thumbscrew (O) so that it may be set at any position, serves to locate the particular pair of spectra under observation. The ground glass screen (G) is provided with a vertical row of numbers which are seen through an opening in the pointer (J) and which correspond to settings of the plate rack on the spectrograph.

The entire instrument is constructed on a rigid wood framework and is covered with masonite or similar material. Doors are provided for access to the lamp and optical system. The ground glass screen (G) may be removed from the metal frame (Q) in which it is held in position by four flat phosphor-bronze springs

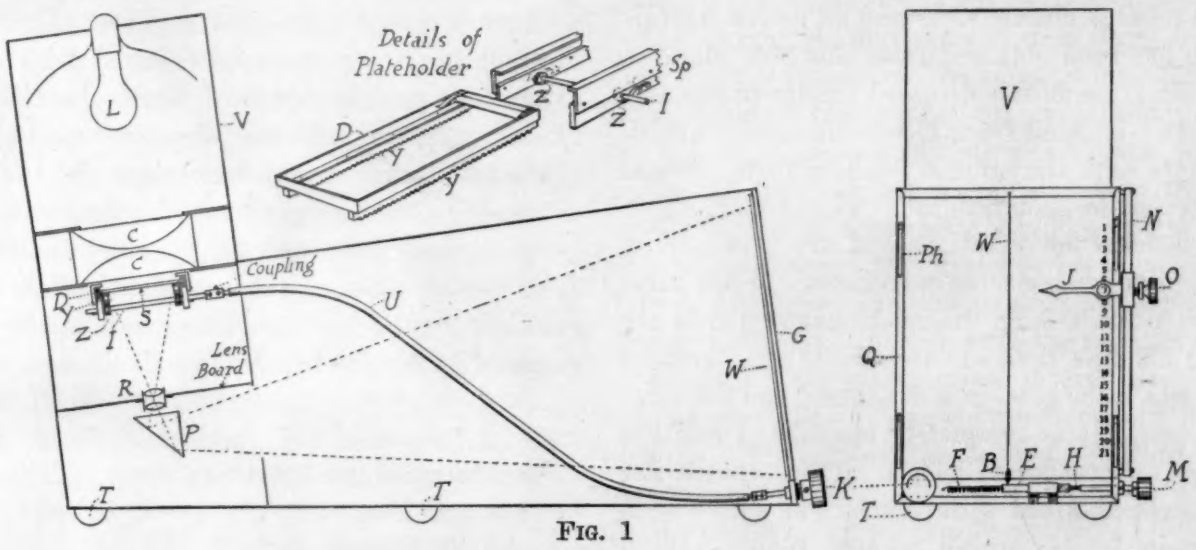

FIG. 1

(Ph). A switch in the lamp circuit is provided near the operating end of the device. Rubber feet (T) are fixed to the bottom to eliminate vibration.

In addition to its use as a comparator for spectrograms, the device can be used to study any photographic plate or for classroom demonstrations. Various other uses will suggest themselves.

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BOOKS RECEIVED

DWYER, HUGH L. *Your Child in Health and in Sickness.* Pp. xvi + 333 + xii. Illustrated. Knopf. $2.75.

HARRIS, L. J. *Vitamins.* Pp. xix + 240. Illustrated. Macmillan. $3.00.

RICHARDS, A. and A. I. ORTENBURGER. *Practical Comparative Embryology.* Pp. 112 + 10. Illustrated. John S. Swift Company, St. Louis. $1.45.

Tôhoku Imperial University. *Science Reports.* First Series. (Mathematics, Physics, Chemistry.) Vol. XXIV. No. 4. Pp. 391–564. Illustrated. *Science Reports.* Fourth Series. (Biology.) Vol. X. No. 3. Pp. 417–638. Illustrated. Maruzen, Tokyo.